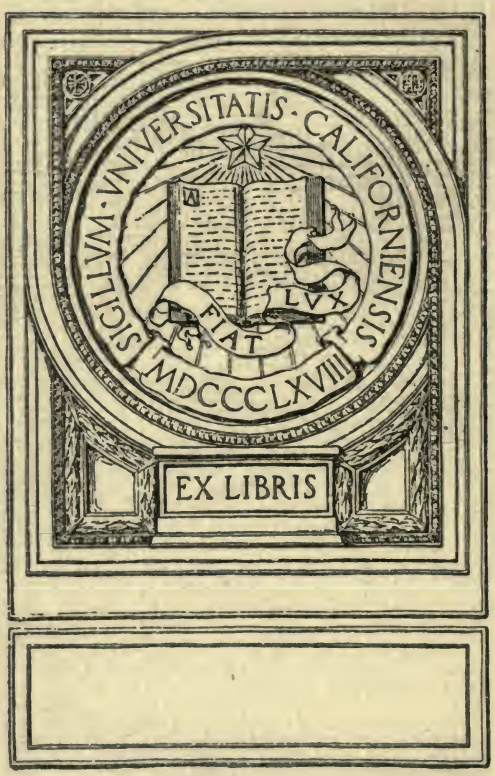
The KNACK of MANAGEMENT

First —
Systematizing the Factory

A. W. SHAW COMPANY
CHICAGO NEW YORK
LONDON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SYSTEMATIZING THE FACTORY

STEPS BY WHICH A RUN-DOWN FACTORY WAS PUT ON A PAYING BASIS

HOW INVENTORY WAS TAKEN
STORES LISTED AND CLASSIFIED
BUYING SYSTEMATIZED
PAYROLL COMPILED

HOW WASTE SPACE WAS UTILIZED AND KINKS IN ROUTINE STRAIGHTENED

By JOHN COAPMAN

A. W. SHAW COMPANY
CHICAGO NEW YORK
LONDON

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LIST OF FORMS AND CHARTS

OVERHAULING A FACTORY

ONE concern made a contract to deliver its product at cost—plus eight per cent. Before that time the real costs on the product were not known until the end of the year.

But the company that bought couldn't wait for the annual inventory of the company that sold.

Because costs had to be known monthly and accurately the seller's factory was completely overhauled—and its methods put on a modern basis. These methods got results.

Whether you carry your costs in a vest pocket note-book or get a detailed weekly cost sheet from your factory you will find ideas in this chapter that will interest and help you.

Each idea has worked.

—L. I. THOMAS

I

WHICH STEPS TO TAKE FIRST

PUTTING a factory on a paying basis requires first the study of all the conditions holding in the old plant. This may seem an obvious statement, yet a good many men make the mistake of starting at once to reorganize the time-keeping department, the material handling department, or other branches without considering each branch's relation to all the others and to the parent trunk.

The first thing I did, consequently, in straightening out the tangle in the factory, was to investigate all the conditions. I found a very loose time-keeping system; no cost-keeping system; materials were purchased without securing competitive bids; no record of quotations.

After I had spent three weeks investigating the conditions, I put down on paper the general plan of organization. I first charted the organization and the duties of the various persons connected with the heads of the departments, and then with the whole plan in view I re-arranged the organization along the lines shown in Chart 2 (page 35).

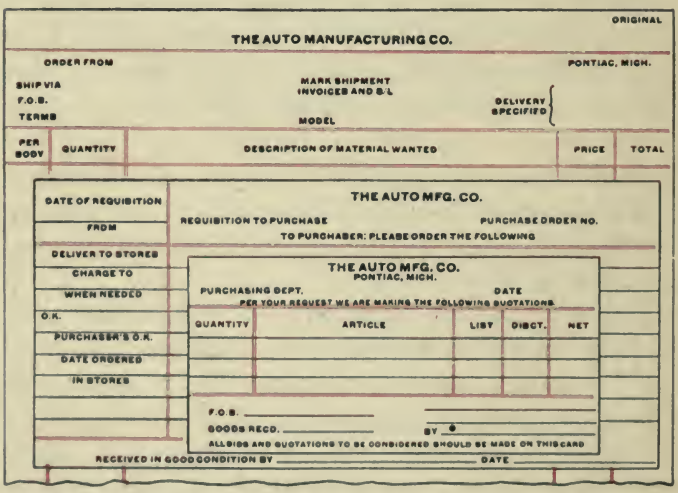
The old organization is shown in Chart 1 (page 34). The purchasing agent seemed to have his hands full. In fact he was unable to give proper attention to any one subject. He had some duties in common with other heads of departments. And as the manager of the factory was present only a comparatively short time during the day a great many things were allowed to pass unnoticed. Such a subject as the maintenance of the plant and equipment, for example, was overlooked, because no one was directly responsible for it.

This organization was boiled down to the form shown in Chart 2. The same men were retained, but the duties and responsibility of each one were diagrammed so that no misunderstanding could exist. After the whole plan had been thoroughly considered and worked out, blue prints of this chart were made and distributed to each department in the factory. This method of distributing information in the factory was followed by putting any part of the new plan into effect. The head of each department received a bound copy of the methods decided upon so that he could understand exactly his relation to all the other departments and to the work of which he was in charge.

When putting such a plan into effect, the hearty co-operation of each individual, which is essential, can be secured by making it of pecuniary advantage to follow out the plans as laid down. The men in charge of departments naturally consider that the plans upon which they were operating are good and do not take very kindly to new burdens imposed upon them by a reorganization or by the rearrangement of the work formerly handled in their departments. By paying a bonus on

daily production the department changes in routine, however, may often be accomplished successfully. After it is explained to the man that he can make more by working out the plan proposed he is not long in deciding that the new plan is at least worth trying out.

After a general plan of organization has been developed the second step is to arrange the methods used from the buying of the raw material to the shipping of the product. An easy way to do this is to take some one particular product and trace its course from start to finish through the plant, putting all the different steps down on paper so that the actual routine used in the factory can be seen graphically. After this has been done it will be found that the purchasing and stores department is a starting point for reorganization.


ORIGINAL

THE AUTO MANUFACTURING CO.

ORDER FROM — PONTIAC, MICH.

SHIP VIA
F.O.B.
TERMS
MARK SHIPMENT INVOICED AND B/L
DELIVERY SPECIFIED
MODEL

PER BODY	QUANTITY	DESCRIPTION OF MATERIAL WANTED	PRICE	TOTAL

DATE OF REQUISITION
FROM
DELIVER TO STORES
CHARGE TO
WHEN NEEDED
O.K.
PURCHASER'S O.K.
DATE ORDERED
IN STORES

THE AUTO MFG. CO.

REQUISITION TO PURCHASE — PURCHASE ORDER NO.
TO PURCHASER: PLEASE ORDER THE FOLLOWING

THE AUTO MFG. CO.
PONTIAC, MICH.

PURCHASING DEPT. — DATE
PER YOUR REQUEST WE ARE MAKING THE FOLLOWING QUOTATIONS

QUANTITY	ARTICLE	LIST	DISCT.	NET

F.O.B.
GOODS RECD. — BY
ALL BIDS AND QUOTATIONS TO BE CONSIDERED SHOULD BE MADE ON THIS CARD

RECEIVED IN GOOD CONDITION BY — DATE

FORMS 1, 2 and 3: The center form is the order on the factory buyer, the form at the back is the buyer's order on the maker, issued after he has accepted the bid made on Form 2 at the front

So in reorganizing this factory the start was made with the requisition blank. As has been said, no regular system of buying had been in

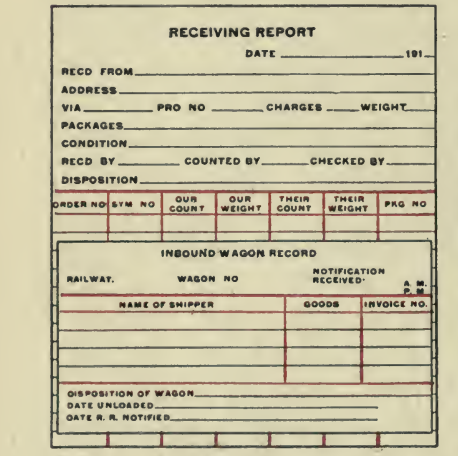
use in the factory. So both the purchasing and stores departments were replanned. When it was necessary for any raw materials, supplies or tools to be purchased, it was arranged so that the department head requiring the material was to make out a requisition called a "requisition to purchase" (Form 1). This was sent from the department head to the superintendent for approval. If the cost was considerable this requisition had also to have the approval of the factory manager, and in cases where purchases amounted to over one hundred dollars the general manager of the plant O. K.'d the requisition. The requisition thus O. K.'d was given to the purchasing agent and constituted his authority for making the purchase.

If the item was something which the purchasing agent had no quotations of on hand a "request for quotation" card (Form 2) was sent to the firm or firms handling the goods required. They had only to fill in the price, sign and return the card. These cards were made standard size (three by five) so that they could be filed conveniently in the indexed drawer and kept as a basis for price on future orders. After the cards were returned a clerk entered the prices upon a quotation record card for general reference.

When a purchase was to be made the order was sent out on a sheet like that shown in Form 3. Three copies of this were made, the original going to the supplier. The first copy was kept by the purchasing agent and the third sent to the storekeeper. The latter checks off the receipts on his copy from the receiving report (Form 4).

What a system of this sort can save is well illustrated in the buying of lumber in this

plant. The company purchased lumber in car shipments and the railroad allowed them forty-eight hours to unload the cars before charging demurrage. An analysis of the first monthly statement revealed the fact that the company was paying over two hundred dollars per month for demurrage charges alone. Some one was immediately asked why.



RECEIVING REPORT

DATE _____ 191_

RECD FROM _____

ADDRESS _____

VIA _____ PRO NO _____ CHARGES _____ WEIGHT _____

PACKAGES _____

CONDITION _____

RECD BY _____ COUNTED BY _____ CHECKED BY _____

DISPOSITION _____

ORDER NO	SYM NO	OUR COUNT	OUR WEIGHT	THEIR COUNT	THEIR WEIGHT	PKG NO

INBOUND WAGON RECORD

RAILWAY. WAGON NO NOTIFICATION RECEIVED A. M. P. M.

NAME OF SHIPPER	GOODS	INVOICE NO.

DISPOSITION OF WAGON _____

DATE UNLOADED _____

DATE R. R. NOTIFIED _____

FORMS 4 and 5: The receiving report keeps the storekeeper and the buyer informed of all incoming goods. While demurrage is saved by giving immediate disposition of incoming cars, on the wagon record

It developed that only one lumber inspector was engaged and it was thought that the business hardly warranted the extra expense of another man whose salary was one hundred dollars a month. Judging from the records another inspector was warranted and he was put on as soon as he was found.

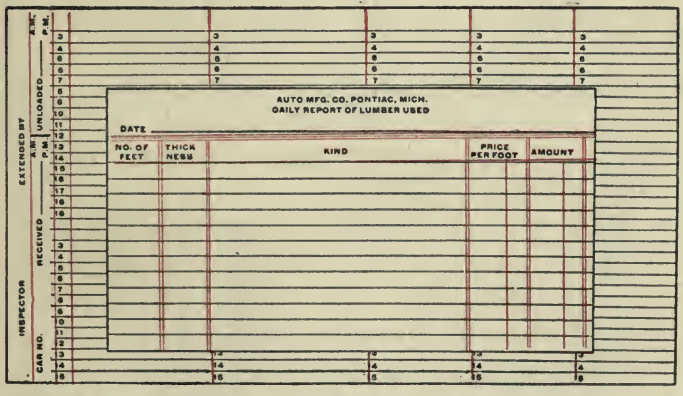
Then, in order to prevent absolutely any more demurrage charges unknown to the management, an "inbound car record" (Form 5) was devised. The local freight agent was requested to notify the storekeeper by telephone as soon as a car consigned to the company arrived in town. The departments manufacturing body tops were housed in a separate building a few blocks away with its own switching facilities. Formerly the railroad would switch cars to one plant that belonged to the other factory building. This meant switching charges which were unneces-

sary. The storekeeper, when acquainted by telephone with the arrival of the car, could consult his records and determine which plant required the goods, and so saved time and switching charges.

Keeping Accurate Track Daily of All Incoming Stock

The storekeeper noted the date of the arrival of the car on his card and filed this record two days ahead. The morning of the second day his first duty was to inspect these cards. All cars which were not unloaded were taken care of before the close of the day, if this was in any way possible, so that he could notify the railroad. The saving resulting from this little system alone was surprising. From thirty to forty dollars a week was saved on demurrage charges alone, not by investing any money in machinery but simply by keeping track of the arrivals, and it only required a few minutes' time each day.

The lumber inspector reported the grades and quantities received on the "lumber re-



FORMS 6 and 7: The wastage in cutting and handling lumber was reduced by use of these forms

port" (Form 6) and the purchases were settled on this basis. Most of the lumber was

put into the kilns shortly after its arrival, the usual time required by the mill departments directly after it had been removed. To check this, however, a "daily record of lumber used" (Form 7) was issued and turned in to the storekeeper by the lumber inspector so that each order could be charged with the proper amount of lumber.

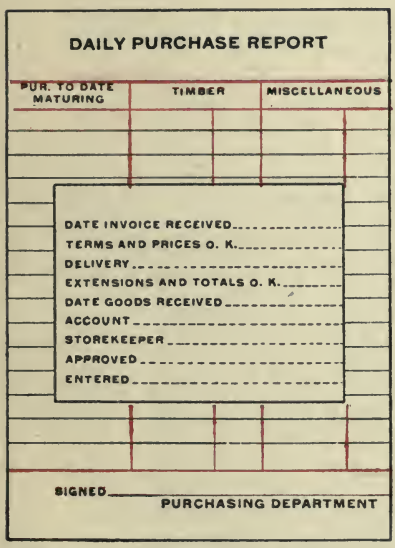
How Waste in Lumber Was Reduced Fifteen Per Cent

This all had an interesting effect on the reduction of the waste in lumber. In the ordinary wood-working plant the waste runs up to thirty or even fifty per cent. After the amount of material required to actually complete the jobs in process was checked against the deliveries of the purchases made, it was discovered that the waste in lumber in this plant was very large.

Foremen and stock-cutters were instructed that the amount of waste must be decreased and the work of the men was analyzed so that it was known definitely who was responsible for the largest wastes. After the first month or two had passed, waste in lumber could be estimated with a certainty as not exceeding twenty-five per cent and ordinarily under fifteen per cent. This meant a big and immediate saving.

When you can save twenty per cent of lumber that costs forty-five dollars per thousand, it means nine dollars on the right side of the ledger for every thousand feet cut. As one or two thousand feet of the stuff was cut up each week it soon amounted to something worth while. Some lumber, of course, cost less than this; some cost more, but the saving was made on all grades and kinds. Another plan which

was put in operation and which saved expense was inaugurated in the purchasing department. This was a daily report of purchases (Form 8). Before this plan was adopted the accounting department would often receive bills for purchases amounting to considerable sums. It was sometimes inconvenient to meet payment due on purchases because the disbursement of a large sum at an unusual time was not planned for.



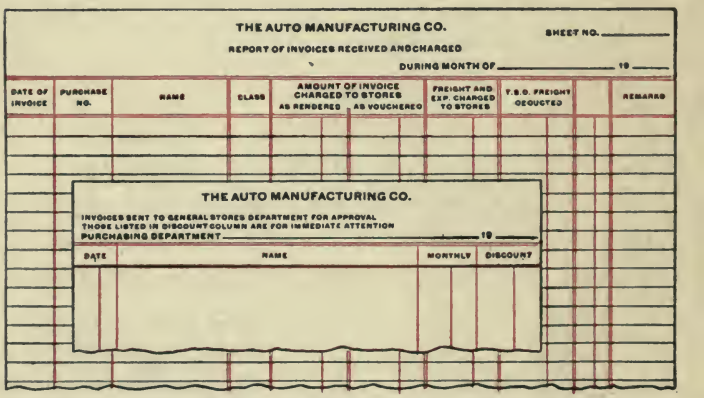
FORM 8 and FIGURE 1: A daily purchase report and a rubber stamp that helped systematize buying

Of course, if an extra large purchase of any kind was made someone would keep it in mind, but trouble was caused in not remembering that an accumulation of many small purchases of medium size often exceeded the so-called big ones. No details were asked for on the purchase report, but at the end of the day the purchase orders issued during the day and the amounts would all be carefully totaled.

This little report alone soon helped to regulate the purchasing department, for the accounting department could easily inform the purchasing department when purchases were being made which might be inconvenient to meet and different terms could be very easily arranged by the purchasing department.

The buying of raw materials was further

facilitated by the prompt handling of invoices. When the mail was opened all invoices were stamped on the reverse side with information like that shown in Figure 1. The invoices were then sent to the purchasing agent who had them checked for prices, terms, deliveries, extensions and totals and charged them against the proper accounts. If they were correct the invoices were then listed on Form 9, known as "invoice list."



THE AUTO MANUFACTURING CO.

SHEET NO. _____

REPORT OF INVOICES RECEIVED AND CHARGED

DURING MONTH OF _____ 19 ____

DATE OF INVOICE	PURCHASE NO.	NAME	CLASS	AMOUNT OF INVOICE CHARGED TO STORES AS RENDERED	AS VOUCHERED	FREIGHT AND EXP. CHARGED TO STORES	F.O.B. FREIGHT DEDUCTED		REMARKS

THE AUTO MANUFACTURING CO.

INVOICES SENT TO GENERAL STORES DEPARTMENT FOR APPROVAL
THOSE LISTED IN DISCOUNT COLUMN ARE FOR IMMEDIATE ATTENTION

PURCHASING DEPARTMENT _____ 19 ____

DATE	NAME	MONTHLY	DISCOUNT

FORMS 9 and 10: The accounting department kept the purchasing agent within his limits by using these forms

The duplicate of this was retained in the purchasing department while the original, together with the invoices, was sent to the storekeeper. The latter noted on the back of the invoice the date the goods were received, and "O. K.'d" it.

These invoices were then listed on Form 10, charged. The original of this report and the invoices were sent to the accounting department from which the checks in settlement were sent out.

THE FACTORY GOVERNOR

ON every steam engine there is a regulating device—a governor that balances the supply of steam with the demand for power. When more power is needed more steam is admitted; when the load decreases the governor automatically lessens the amount of steam fed to cylinder.

In every factory one man performs a similar function—he balances the work of the factory with the sales and administration policies of the business. Without him the business is out of balance in one direction or another.

A factory manager must keep the balance between cost to produce, quality of product and service to the customer.

—F. M. Feiker

II

FINDING WHAT THE FACTORY IS WORTH

WHEN a new business is launched or an old one taken over, the first duty is to ascertain the assets. Inventory is taken. Everything about the plant or the premises is counted and weighed. After everything is inventoried the next step, which many consider the most difficult, is the process of placing valuation upon the goods. Many methods are in vogue for this and a different one is necessary for practically every firm.

As was explained in a preceding chapter, after the goods are ordered, shipped, received and paid for they represent just so much money and should be treated as such. One thing more, many buyers will often make a purchase because the price, free on board at the factory of the maker, is less than what they might be able to get in their own town. The cost of freight or express charges and the cartage does not appear to them as expense that should be included in the cost of the article. One gentleman informed me upon one occasion that the company hired a team by the day to do the hauling from the freight house and as for the freight or express, "Oh,

a very small matter of little or no consequence!" He changed his mind later on when he was obliged to move to another city and had the freight to pay on his furniture.

A general stores ledger card (Form 11), upon which was entered the purchase order and the receipts as shown by the receiving reports, was planned. As the freight or express bills were received with the goods, in most cases it was a simple matter to enter these upon the card with the receiving report. The matter of cartage was more or less hazy. Oftentimes the driver would bring back from the freight house several various articles weighing different amounts. Where possible these were apportioned, but when this was out of the question we charged them to "miscellaneous freight and cartage." All withdrawals from stock were entered on this ledger and taken from the requisition blanks.

One thing I found very much in evidence was the ease with which supplies, such as nails, screws, sandpaper, and so on, could be obtained. The stockkeeper admitted that he had been told not to allow any goods to leave without a requisition. "But the boys would sometimes forget to get one from the foreman and I didn't like to make them go back," or else "Henry was building a little chicken-coop and wanted a few nails, not very many, you know—oh, a couple of handfuls or so—and I kind of wanted to be obliging, so let him have them. Don't cost very much, I don't suppose."

Instructions were immediately issued to all department heads that in no case would material be issued from stock without an order (Form 12) signed by them. The stockkeeper was informed that if any more instances were found of material leaving his department

SEC. NO. _____
BIN NO. _____
SYMBOL _____

THE AUTO MFG. CO.

DESCRIPTION _____

MAX. _____
MIN. _____
ARTICLE _____

GOODS RECEIVED									GOODS WITHDRAWN					ON HAND	
DATE	P. O. NO.	FROM WHOM	QUANTITY	PRICE	FRT. OR EXP.	CARTAGE	COST	AMOUNT	DATE	DEPT.	SHOP NO.	QUANTITY	AMOUNT	QUANTITY	AMOUNT

EQUIPMENT NO. _____ SERIAL NO. _____ EQUIPMENT _____

EQUIPMENT REPAIRS

DATE	STORES	LABOR	DATE	STORES	LABOR	DATE	STORES	LABOR	DATE	STORES	LABOR	DATE	STORES	LABOR	DATE	STORES	LABOR

FORMS 11 and 16: At the back is the general store's ledger card upon which receipts are checked with purchase orders; the other form known as an equipment sheet, is used to keep track of the cost of repairing machinery

without the necessary papers he could consider himself discharged and with no recommendation. This had a salutary effect upon the whole plant immediately. A few remarks were made that the company was getting mighty close all of a sudden.

The stockkeeper in each of the stock departments recorded his stock receipts and disbursements upon the stock card shown by Form 13. The various bins and aisles were numbered and upon each bin was attached a card holder so that bin stock cards (Form 14) might be kept there. As articles were removed or placed therein it was noted upon the card, thus enabling one to tell the quantity contained without being obliged to consult the records at the desk.

It was soon found necessary to inventory the plant. This had been done about six months previously but no one cared to take the responsibility of the figures shown, and upon

GENERAL STORE DEPT.

DATE_____

PLEASE SUPPLY THE FOLLOWING MATERIAL, AND DEBIT TO

SHOP NO._____ LOT NO._____

QUANTITY	SYM. NUMBER	ARTICLE	AMOUNT	

ORDER FILLED BY_____ FOREMAN_____

FORM 12: This standard requisition for material stopped petty losses of stock

investigation it was found that they didn't check up "within a mile." Preparations were

made for this some two weeks previous to the time set. The manager and department heads calculated that at least three days were neces-

FINISHED STOCK RECORD

NAME_____ PART NO._____

NO. REQUIRED_____ SECTION NO._____ BIN NO._____

DATE	QUAN. RECD.	TOTAL	OUT ON ORDER	TOTAL	BAL. ON HAND	RE-MARKS

FORM 13: A balance sheet for stock on hand in the stores

sary. I suggested that we shut down Thursday night and take Friday and Saturday morning, but their previous experience had taught them that three days were none too much. It wasn't, with their method of but two men in the department—one to call off and the other to record.

First of all, tags similar to that shown in Figure 15 were ordered from the printer. These were numbered consecutively and a record was kept as to the department receiving them. At a meeting of the foremen the reasons for this inventory and the importance of its correctness were explained. On some floors

were located portions of one or more departments and it therefore became necessary to divide the jurisdiction of each foreman so that the best results would be obtained.

All machinery and equipment were turned over to the foreman of the mill department and he was given the millwright as first assistant. In the other departments, where it was found that interference might result because of too many cooks, one foreman was made responsible for his floor and given the other foreman as his first assistant. As the plant was to be closed for three days orders

PART NO._____ SECTION NO._____ BIN NO._____

NAME_____

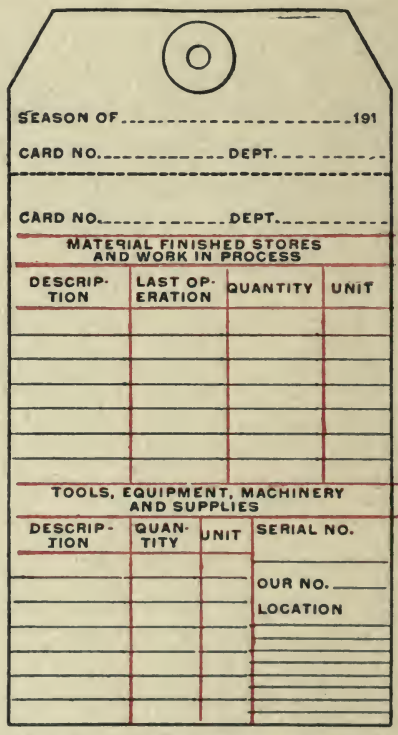
IN		OUT					
DATE	QUANTITY	DATE	QUANTITY	BAL.	DATE	QUANTITY	BAL.

FORM 14: A label used to keep track of the stock in each bin. All disbursements are noted on it

were issued to the various department heads to retain as many of their men as they considered necessary. The storekeeper was placed in full charge of all inventory work

and was assisted by the head of the cost department.

The plant closed on Wednesday night, and Thursday morning the work of distributing the tags was begun. Instructions had been issued to the effect that everything in the plant was to be tagged. If a lot of parts were found in one portion of the department and another lot in another portion, each individual lot was to be tagged. This required the best part of Thursday morning.


SEASON OF.....191

CARD NO.....DEPT.....

CARD NO.....DEPT.....

MATERIAL FINISHED STORES AND WORK IN PROCESS

DESCRIPTION	LAST OPERATION	QUANTITY	UNIT

TOOLS, EQUIPMENT, MACHINERY AND SUPPLIES

DESCRIPTION	QUANTITY	UNIT	SERIAL NO.
			OUR NO.
			LOCATION

FORM 15: These tags were used to mark all the facts while taking inventory

The foreman then delegated to each workman the task of counting or weighing the various lots. One man would be instructed to take a certain number of lots and was told to simply weigh or count the articles and mark the number on the tag. No other information was desired from him. The foreman would then follow and fill out the balance of the tag, tearing off the lower portion which was later sent to the office.

By Thursday night practically everything had been inventoried. The foreman then made the rounds of his territory and removed the stubs which were left from the day pre-

vious. This constituted a check on his work. Because it became necessary for him to visit each lot he could see whether or not it had been inventoried. These stubs were also turned in to the office where they were checked up with the remainder of the tags to make certain that all tags were in.

The tags were sorted according to departments and then to materials. After this was done it was a comparatively easy task to price them when they were listed as:

Tag No. Article Quality Price Value

By totaling this list for each department the value of that department financially was shown by the inventory. To get the total valuation it then was necessary to total the values of the individual departments. After this was done the storekeeper could obtain the quantities of material throughout the plant and after deducting from outstanding orders was able to show the net amount on hand.

This took care of all the stock in a very satisfactory manner, but gave no record of machinery and equipment. For valuing this class of assets it became necessary to call in the service of a machinery dealer as some of the equipment was of an unknown age. Equipment sheets were then devised (Forms 16 and 16a) to record all information required regarding the equipment.

One of these sheets was issued for each piece of equipment. Where the name of the manufacturer and dealer were known, this was recorded and if no invoice could be found a letter was sent requesting a duplicate invoice. The date of purchase was also essential, as was the date of manufacture, providing it was purchased second hand. The freight bills were also located wherever possible and the cartage

EQUIPMENT RECORD

DEPARTMENT _____

EQUIPMENT _____ SERIAL NO. _____ TO BE WRITTEN OFF AT END OF _____ YRS EQUIPMENT NO. _____

MADE BY _____

PURCH. FROM _____

P. O. NO. _____ INV. NO. _____

EQUIPMENT		FREIGHT		CARTAGE		PULLEYS			BELTING		ERECTING			MISCELLANEOUS		TOTAL COST
DATE	AMOUNT	DATE	AMOUNT	DATE	AMOUNT	SIZE	COST	CHGS.	SIZE	COST	MONTH	LABOR	STORES	ITEMS	AMOUNT	
TOTALS																

YEAR	%	AMOUNT	VALUE	%	AMOUNT	VALUE		AMOUNT	VALUE	TOTAL VALUES	REPAIRS	REMARKS

FINAL DISPOSITION _____ SALVAGE _____ LOSS _____

APPROVED BY _____

FORM 16a: Is the reverse side of Form 16 and is used as a record of the entire history of a machine, showing if it is earning its correct hourly wage

bills. These two items, however, were rather hard to get. The cost of pulleys and belting was easy to obtain from the catalogues and price lists.

When a new machine was purchased the head of the cost department issued an equipment sheet from the purchase order. An equipment number was also assigned at the time. A note was made on the purchase order giving this number and requesting that it be painted on the machine. Upon arrival it was possible to obtain the freight bills, also the cartage charges. All requisitions for belting, pulleys, and so on, and also labor and supplies in erecting them, were charged to this number. It will be seen that once started the complete cost of the machine installed ready to run was put on record.

The probable life of the machine was decided upon and this was noted at the top of the sheet. If the machine cost $1,000 and it was decided its life was finished at the end of ten years, that machine should pay for itself and also pay interest within that time. Six per cent was taken as a fair rate of interest and Table 1 (Page 36) was compiled to facilitate calculations.

To get a little ahead of the story, it was now an easy matter to keep track of all time that the machine was operated by having the workman note the number of his machine on his time card. Observation showed that the average machine was operated about one hundred and sixty-six hours per month, or two thousand hours per year. At this rate if it were desired to retire this machine at the end of ten years it must be credited with $133 per year, this amount to be distributed over the various jobs produced on this machine. Ac-

cording to Table 1 it is seen that it is necessary to charge each job with $0.0665 for every hour that the machine is used.

The amount each machine must earn per year is arrived at by multiplying the amount to be earned per hour as shown in Table I by 2,000, the number of hours in a working year.

By means of this chart the value of each machine was known, since a record of how many hours it was operated, and how much to charge each hour, was available. When the time came to scrap the machine there was a complete history of it.

As the inventory cards came into the office they were filed for the time according to departments. After they had all been received they were then divided as to machinery or equipment, finished work and that in progress. After being priced it was an easy matter to list them by their class under the departments.

The main building was of brick, containing the office, paint shop, shipping and assembling departments. The mill work was done in an abutting building of frame construction. One or two changes were made in the location of departments from one building to the other and thereby saved a trifle on the insurance.

Building	Amount Carried	Old Rate	Premium	New Rate	Premium	Saving
Brick	$10,000	$2.80	$280.00	$2.00	$200.00	$80.00
Frame Addition to Brick	5,000	3.85	192.50	3.05	152.50	40.00
Dry Kiln	3,500	No Previous Rate		3.30	115.50	
Bending Room	2,000			3.30	66.00	
Drying Room	1,000			3.30	33.00	
Lumber	18,000	1.87	336.60	1.58	284.40	52.20

Above is a copy of the old and new rates, together with the saving in premiums. To obtain this saving required an outlay of less than twenty dollars.

LAWS FOR MANAGERS

A MODERN shop must be more or less of a schoolhouse, and in it the manager must be one of the pupils.

Equipment is not the best because we own it.

Obsolete machinery is the foe of profits, the brother of high cost and the friend of bad methods.

A thing is not right because we do it.

None of us can afford to be deceived by our own affairs.

It is better by self-criticism to find and correct our own faults than to have our customers do it for us.

—William C. Redfield

III

CHECKING THE PAY ROLL WITH COSTS

IT had been the custom in this plant since its first inception to call the factory manager, superintendent or foreman whenever an applicant for employment presented himself. The request for an interview was usually made to the telephone operator, whose desk was near the office entrance. Since she was well acquainted with most of the inhabitants of the town and desirous of pleasing everybody and aiding her friends, the operator would immediately create confusion in the whole plant, if necessary, in her somewhat overzealous endeavor to locate the department heads. She was no respecter of persons and it mattered not that the person she desired was in conference. Usually he would come to her desk, ascertain her desires and would then talk with the applicant.

This plan of hiring men was abandoned. The accounting department was housed in a room adjoining the entrance as is shown by the office arrangement (Chart 3, page 33). The location of the timekeeper was changed and a window was cut in the partition at his back. How the office was rearranged is also made

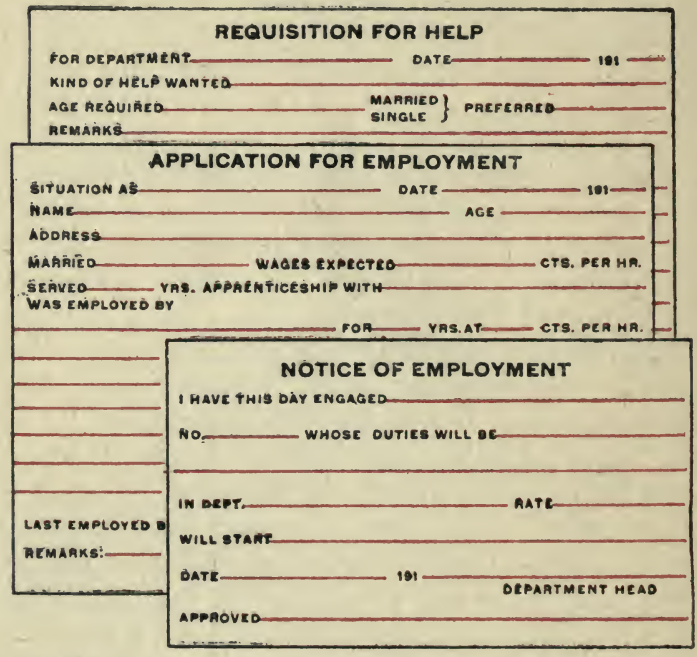
clear. Just above the window was mounted a blueprint (Chart 4, page 31). This chart was called the "Employment Chart" and the timekeeper could tell at a glance just what class of employees were in demand throughout the various departments. The employment department was turned over to the timekeeper. Each department head would issue a "Requisition for Help" (Form 17) when in need of help of any kind. One of these requisitions was issued for each person desired. Upon receipt of these the timekeeper would place a peg or glass-headed push-pin in one of the squares opposite both the department and the class of employees.

When an applicant presented himself it was a very simple matter to tell whether or not he was needed. If not, he was requested to fill out an application as shown by Form 18, providing the timekeeper thought that the company would ever care to engage him. These applications were retained on file and when a requisition for this grade of help was received the applicant was sent this form letter:

> "You will recall having left with us an application for a position. We now have a vacancy and would be glad to have you call on the writer for an interview at your earliest convenience. In case you are unable to call, or do not care to consider a position with us at this time, kindly advise us by return mail, or telephone Mr. ———, who will endeavour to place you to our mutual advantage.
>
> "Yours very truly,
>
> "Auto Mfg. Co."

If the applicant failed to appear possibly others might be tried unless the supply was abundant and the demand urgent, and in that case the first promising-looking candidate would be ushered to the foreman. If upon the

close of the interview he decided that the applicant was suitable for the position he would fill out a copy of "Notice of Employment" (Form 19) and instruct the applicant to turn it in to the timekeeper on his way out.


REQUISITION FOR HELP

FOR DEPARTMENT _____ DATE _____ 191 ____

KIND OF HELP WANTED _____

AGE REQUIRED _____ MARRIED / SINGLE } PREFERRED _____

REMARKS _____

APPLICATION FOR EMPLOYMENT

SITUATION AS _____ DATE _____ 191 ____

NAME _____ AGE _____

ADDRESS _____

MARRIED _____ WAGES EXPECTED _____ CTS. PER HR.

SERVED _____ YRS. APPRENTICESHIP WITH _____

WAS EMPLOYED BY _____

_____ FOR _____ YRS. AT _____ CTS. PER HR.

NOTICE OF EMPLOYMENT

I HAVE THIS DAY ENGAGED _____

NO. _____ WHOSE DUTIES WILL BE _____

IN DEPT. _____ RATE _____

LAST EMPLOYED B

WILL START _____

REMARKS: _____

DATE _____ 191 _____

DEPARTMENT HEAD

APPROVED _____

FORMS 17, 18 and 19: These self-explanatory blanks are used in hiring men

The timekeeper then assigns a number to the new workman and calls his attention to a copy of the shop rules which are posted in a conspicuous place. A payroll card and also an operation card (Forms 20 and 21 respectively) are then made out and placed in the clock-rack in the department. At the same time a clock-record card is filled out (Form 22) and placed in the file for future use.

Upon his arrival for work the employee detaches his "pay check" from the payroll card and registers his arrival on it. He then reports to the foreman for work. When as-

EMPLOYMENT CHART

	LABORERS AND HELPERS	SAWYERS	SHAPERS	STICKERS	PLANERS	BORING MACHINE	JOINTERS	BENDERS	CARVERS	MOLDERS	ROUGH SEAT MAKERS	FRAMERS AND PANELERS	SURFACERS	DUSTERS	FINISHERS	PASTERS	MACHINE	TOP BUILDERS	BOW COVERING	BOW SETTING
LUMBER YARD AND DRY KILN																				
MACHINE DEPT.																				
BENDING DEPT.																				
UNDERBODY DEPT.																				
SEAT DEPT.																				
ASSEMBLY DEPT.																				
SHIPPING																				
MILLWRIGHT																				
STORES																				
BOW SETTING DEPT.																				
BOW COVERING DEPT.																				
CUTTING DEPT																				
STITCHING DEPT.																				
PASTING DEPT.																				
TOP BUILDING																				

DENOMINATION OF PAY ROLL

DEPARTMENTS	DOLLARS					CENTS					TOTALS	
	20.00	10.00	5.00	2.00	1.00	.50	.25	.10	.05	.01		
TOTAL DENOMINATIONS												
TOTAL AMOUNT OF DENOMINATIONS												

TOTAL BY DEPARTMENTS MUST BALANCE WITH DEPARTMENTAL TOTAL FROM LEDGER

GRAND TOTAL FROM DEPARTMENTS MUST BALANCE WITH GRAND TOTAL FROM LEDGER

GRAND TOTAL AMOUNT OF DENOMINATIONS MUST BALANCE WITH GRAND TOTAL FROM LEDGER.

BALANCE EACH DEPARTMENT AS YOU GO ALONG.

CHART 4 and FORM 33: The Employment Chart showed the timekeeper exactly what the labor requirements were; while the denomination sheet helped in handling the pay

signed to a job, he registers "in" upon his operation-card at the time-clock.

An attempt was made to control the production so that a foreman could keep his men employed on but possibly one or two jobs a day or week. At the end of the day or job the employee would punch his operation-card out. As the pay period was a half month the card was printed for this period.

A workman might use but one operation-card for the whole pay-period and then again he might have one for every day or oftener. If a great many cards were used, the superintendent was asked to investigate. This was necessary because at first the foremen of some departments did not plan their work right and would often assign a man a small job of little or no consequence simply because he did not know what to do next.

The operation-cards were turned in to the timekeeper upon the completion of the job or in any case at the end of the pay-period. When the job was finished the elapsed time was known and from this the labor costs could be computed. The payroll-card in this case merely served as a check because the operation-cards should check up with the payroll-card.

It is needless to say that at first they didn't. In some instances there would be a difference of over one hour on some days. This was explained in many cases by the workman in that he was waiting for a new job. Not always would he loaf one hour between any two jobs, but in some cases where it was necessary to have him work upon three or four in the course of the day he would be forced to lose twenty to twenty-five minutes, waiting. A record was kept of this and at the end of the

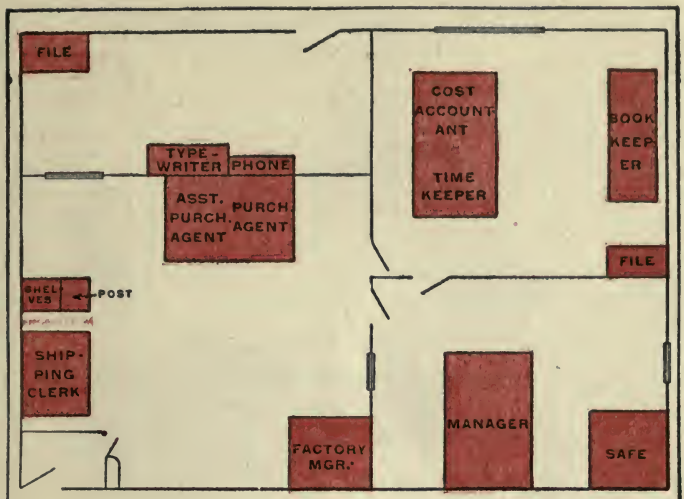
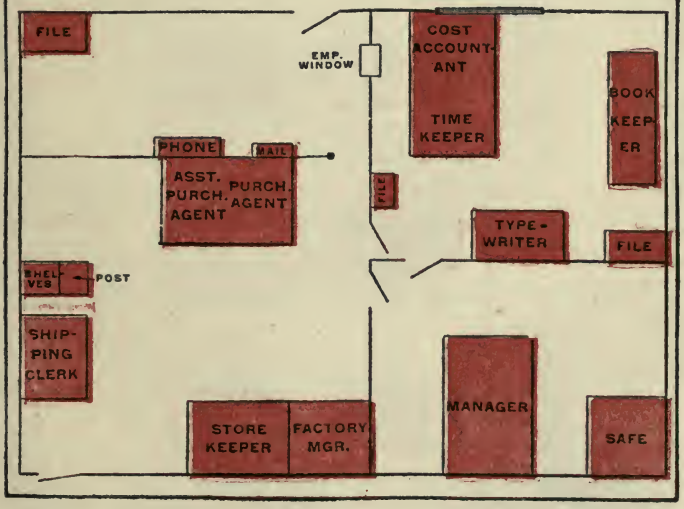


CHART 3 (Page 28): The before and after arrangements of the factory office are shown here. The new office arrangement below facilitated the discharging of employees



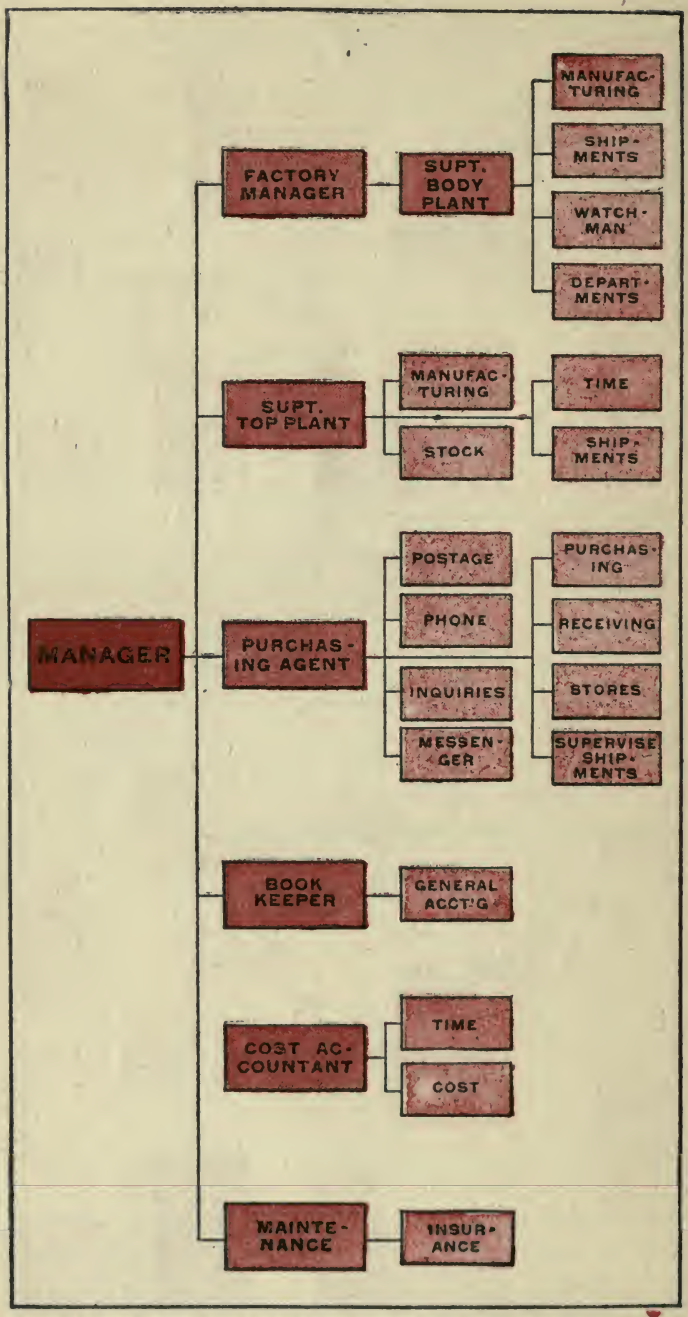


CHART 1, (Page 7): This is a plan of the factory before it was organized. Notice the details handled by the purchasing agent

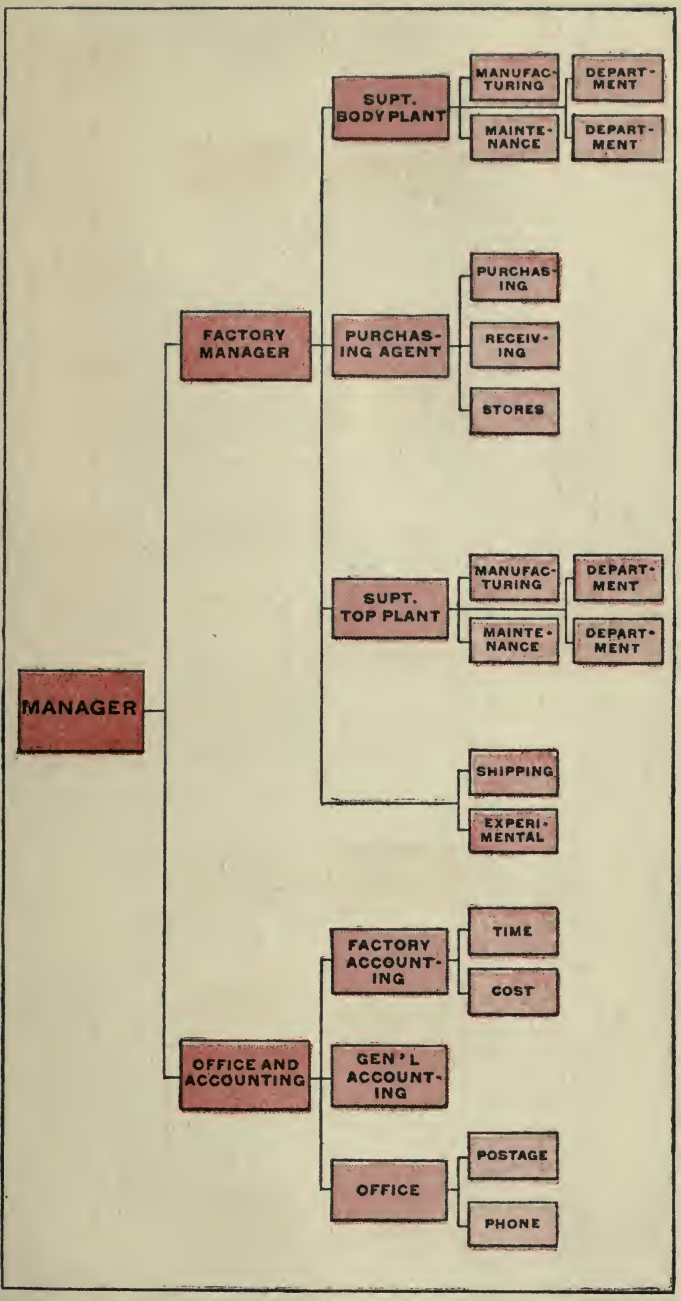


CHART 2, (Page 6): The plan of the re-organized factory, showing a proper distribution of responsibility

HOURLY WAGE FOR ANNUAL AMOUNTS
STANDARD TIME 2,000 HOURS PER YEAR

AM'TS	YEARS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	YEARS 20
$ 25.00	$.0132	$.0068	$.0046	$.0036	$.0029	$.0025	$.0022	$.002	$.0018	$.0016										
50.00	.0265	.0136	.0092	.0072	.0059	.005	.0044	.0039	.0036	.0033	.003	.0029	.0027	.0026	.0024	.0023	.0022	.0021	.002	.002
100.00	.053	.0272	.0184	.0143	.0118	.01	.0088	.0078	.0072	.0066	.0061	.0058	.0054	.0052	.0049	.0046	.0045	.0043	.0041	.004
200.00	.106	.0545	.368	.0286	.0236	.0201	.0176	.0156	.0144	.0133	.0123	.0116	.0109	.0104	.0098	.0093	.009	.0086	.0083	.0078
300.00	.159	.0817	.0552	.0429	.0354	.0302	.0264	.0234	.0216	.0199	.0184	.0173	.0164	.0155	.0147	.0140	.0135	.0129	.0125	.012
400.00	.2012	.109	.0736	.0572	.0472	.0403	.0352	.0312	.0288	.0266	.0245	.0231	.0218	.0206	.0197	.0187	.0182	.0173	.0166	.016
500.00	.265	.1362	.0933	.0718	.059	.0504	.0442	.0396	.0361	.0332	.0309	.0289	.0273	.0259	.0246	.0234	.0226	.0216	.0208	.02
600.00	.318	.1634	.112	.0862	.0708	.0605	.0531	.0476	.0423	.0399	.0370	.0347	.0329	.0311	.0296	.0281	.0272	.0259	.0250	.024
700.00	.371	.1906	.1305	.1005	.0826	.0705	.0619	.0555	.0505	.0465	.0431	.0405	.0382	.0361	.0345	.0327	.0316	.0302	.0292	.028
800.00	.424	.2178	.1491	.1149	.0945	.0807	.0708	.0634	.0577	.0532	.0494	.0463	.0437	.0415	.0392	.0374	.0362	.0346	.0335	.032
900.00	.477	.2452	.1679	.1293	.1061	.0907	.0796	.0714	.0649	.0598	.0566	.0520	.0491	.0466	.0444	.0421	.0407	.0389	.0375	.036
1000.00	.53	.2725	.1865	.1437	.118	.1008	.0885	.0793	.0722	.0665	.0618	.0579	.0546	.0518	.0493	.0468	.0452	.0432	.0417	.04
1100.00	.583	.30	.2051	.1581	.1299	.1108	.0973	.0872	.0794	.0731	.0679	.0636	.0601	.0569	.0542	.0515	.0497	.0475	.0458	.044
1200.00	.636	.3272	.2238	.1724	.1417	.1209	.1061	.0951	.0866	.0798	.0741	.0695	.0655	.0621	.0592	.0561	.0542	.0519	.05	.048
1300.00	.689	.3545	.2424	.1868	.1535	.1310	.1150	.1006	.0938	.0864	.0803	.0752	.0710	.0674	.0641	.0608	.0587	.0561	.0541	.052
1400.00	.742	.382	.2610	.2012	.1653	.1411	.1239	.1120	.1002	.0931	.0865	.0810	.0715	.0725	.069	.0655	.0633	.0605	.0583	.057
1500.00	.795	.4097	.2798	.2155	.1771	.1512	.1327	.1189	.1083	.0997	.0927	.0858	.0819	.0777	.074	.0702	.0678	.0648	.0625	.061

TABLE 1, (Page 25): This chart shows the hourly wage scale to be charged to machinery costing from $25.00 to $1500.00 which is to be retired at any time from one to twenty years. The rates include all interest and show the amount to be charged per hour to earn the cost of the machinery in a given number of years

pay-period the factory manager and each of the superintendents were supplied with a report of the time lost by the various workmen from this cause. A short meeting of the foremen was held each morning and it was a simple matter for them to bring the subject up. After the plan was understood, the losses decreased.

A number of the employees worked upon a piece-work basis and for these a somewhat different system was tried. Piece-workers registered their arrival upon the payroll-card the same as the other employees, but instead of the operation-cards they turned in a daily report of their work to the foreman to be approved by him and then forwarded to the time department. These piece-work reports, shown in Form 23, were entered upon the "Employees' Piece-Work Record" (Form 24) by the timekeeper.

In case it became necessary to change a piece-worker over to day-work he punched the operation-card the same as a day-worker with this exception: At the beginning of his day-work he was obliged to obtain an operation-card properly filled out by the foreman. At the close of the day this card must be dropped in the box for "Jobs Completed," located at the clock.

The foreman was instructed to mark "piece-worker" across the top of the card as these cases were the exception and not the rule, and therefore there was likely to be some delay to the workman in receiving his full wages. These operation-cards were also entered upon the "piece-work record" and the payroll for the piece-workers was made up from this. Probably the employee would rarely, if ever, work upon more than two dif-

OPERATION CARD

SHOP ORD. _____ LOT ORD. _____

PART NO. _____

NO. OF PARTS _____

OPERATION _____

WORKMAN'S NO. _____

NAME _____

MACHINE _____ DATE _____

DATE	IN	OUT	IN	OUT	IN	OUT	TOTAL
1-16							
2-17							
3-18							
4-19							
15-39							
31							

TOTAL TIME _____ HRS.

RATE _____

TOTAL WAGES $ _____

PIECE WORKER'S DAILY REPORT

DATE _____ SHOP ORDER _____

EMP. NAME _____ EMP. NO. _____

QUANT.	OPER NO.	ARTICLE	SERIAL NUMBERS	RATE	AMT.

APPROVED _____

DEPT. NO. _____ FOREMAN

FORMS 21 and 23: These operation cards are put in racks at the clocks. Piece workers use a daily report instead of an operation card

PAY CHECK

NO._____

PAY ENDING _____ 191__

TEAR OFF THIS CHECK AND PRESERVE CAREFULLY UNTIL HANDED IN FOR PAY.

OVER

PAY ENDING_____ 19____

NO._____

NAME _____

DATE	MORNING		AFTERNOON		OVERTIME		TOTAL
	IN	OUT	IN	OUT	IN	OUT	
1 - 16							
2 - 17							

DUPLICATE PAY CHECK

NO. _____

PAY ENDING

RECEIVED PAYMENT

(SIGN HERE)

14 - 30							
15 - 31							

TOTAL TIME_____ HRS.

RATE _____

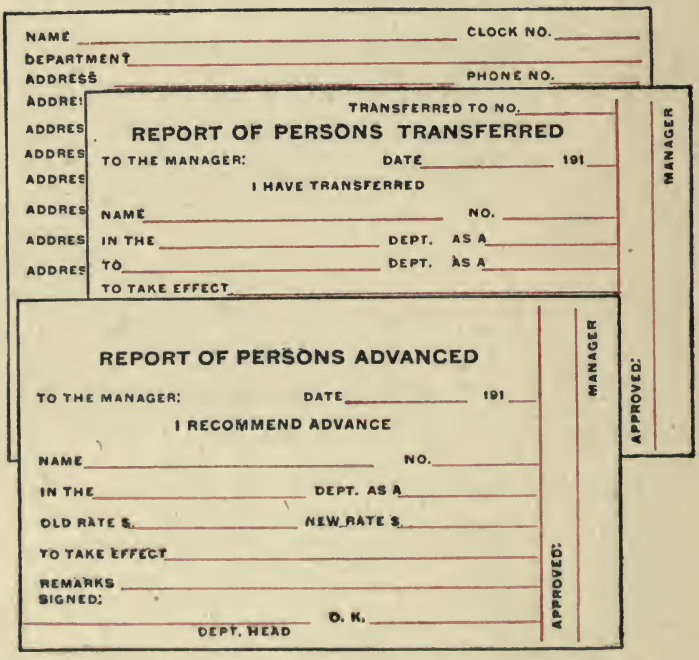
TOTAL WAGES_____

FORMS 20 and 26: A stub tag pay roll card is used with Form 21 for day workers. A red card, Form 26, identifies the man who has lost his regular pay check

ferent orders during a pay-period; but a different "record" to each order number was assigned. After the completion of the order the cards were filed under that number, with other data relating to it.

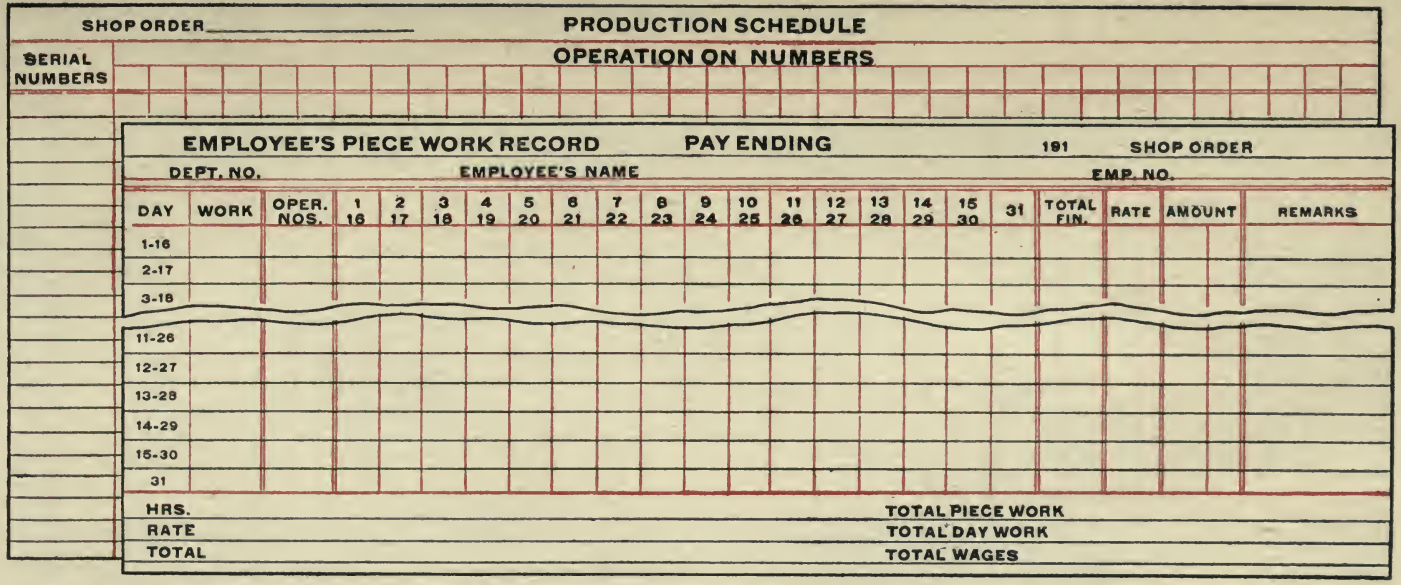
All operations in assembling or building bodies or tops were given a serial number and the employee was instructed to note this number upon his piece-work report, or, if a day-worker, upon the back of his operation-card.

In the factory manager's office was kept a "production schedule" (Form 25) upon which was noted the employee's number, op-


NAME _____ CLOCK NO. _____
DEPARTMENT _____
ADDRESS _____ PHONE NO. _____
TRANSFERRED TO NO. _____
REPORT OF PERSONS TRANSFERRED
TO THE MANAGER: DATE _____ 191__
I HAVE TRANSFERRED
NAME _____ NO. _____
IN THE _____ DEPT. AS A _____
TO _____ DEPT. AS A _____
TO TAKE EFFECT _____
MANAGER
REPORT OF PERSONS ADVANCED
TO THE MANAGER: DATE _____ 191__
I RECOMMEND ADVANCE
NAME _____ NO. _____
IN THE _____ DEPT. AS A _____
OLD RATE $ _____ NEW RATE $ _____
TO TAKE EFFECT _____
REMARKS _____
SIGNED: _____
DEPT. HEAD
O. K. _____
APPROVED:
MANAGER
APPROVED:

FORMS 22, 27 and 28: When a man is hired, advanced, or transferred the facts are accounted for on these blanks

posite the body and operation numbers, as shown on his card. This was used as a means of reference, and also as a check to prevent an employee from turning in a claim for work



SHOP ORDER _____ PRODUCTION SCHEDULE

SERIAL NUMBERS | OPERATION ON NUMBERS

EMPLOYEE'S PIECE WORK RECORD PAY ENDING 191 SHOP ORDER

DEPT. NO. EMPLOYEE'S NAME EMP. NO.

DAY	WORK	OPER. NOS.	1 16	2 17	3 18	4 19	5 20	6 21	7 22	8 23	9 24	10 25	11 26	12 27	13 28	14 29	15 30	31	TOTAL FIN.	RATE	AMOUNT	REMARKS
1-16																						
2-17																						
3-18																						
11-26																						
12-27																						
13-28																						
14-29																						
15-30																						
31																						

HRS. TOTAL PIECE WORK

RATE TOTAL DAY WORK

TOTAL TOTAL WAGES

FORMS 24 and 25: Here are shown the production schedule and employees' piecework record. A statement of all piecework done on each operation is entered on the latter by the cost department

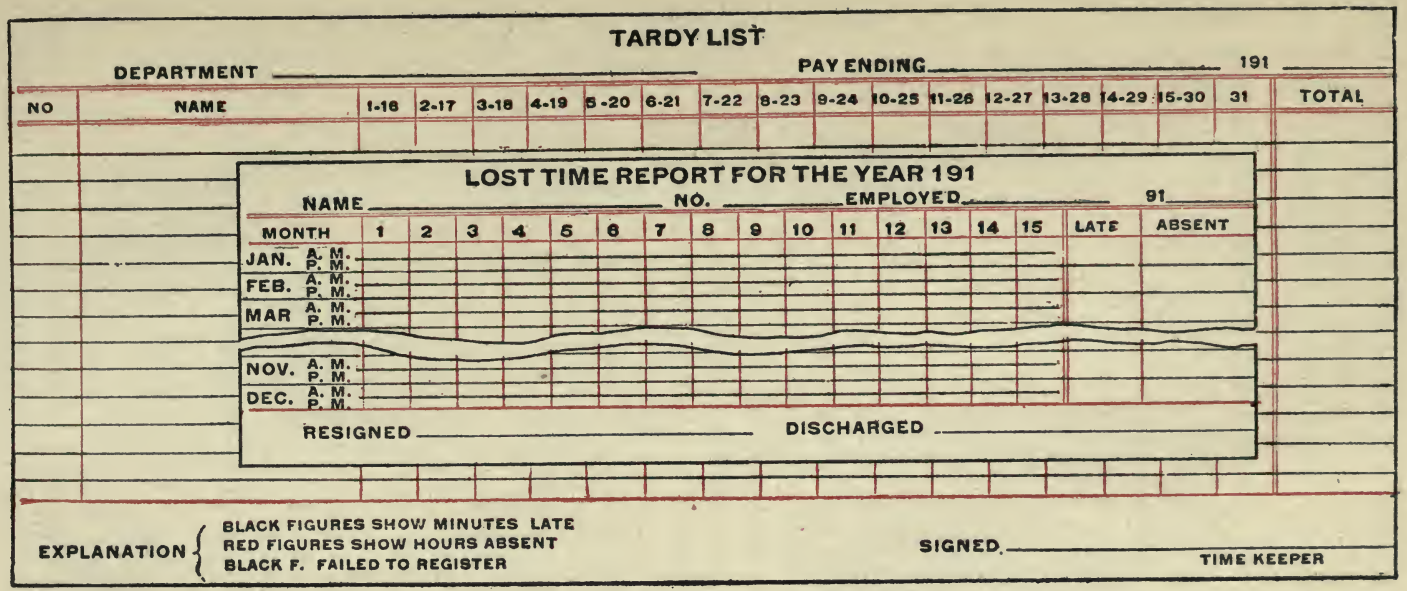
performed by some one else. This alone showed up some money that had been going out of the firm's hand which should have remained. If employees would report work done which they had not performed, when this system was started, it was reasonable to assume that they had been doing it for some time past.

At first it was found that piece-workers would invariably quit about thirty minutes before the whistle on pay-day, and would come down to the office for their money. These, together with the men who had either left the company or were not working, would require an hour or more of the paymaster's time. He had all he could attend to. The employees' attention was called to that clause in the rules to the effect that they would not receive their wages until after quitting-time. Of course, this was objected to, but like all such matters soon died of itself.

These same piece-workers would also quit fifteen minutes or more before quitting-time at noon and in the evening each day. They argued that their time was their own and so did the foremen, but after it was pointed out to the latter that the overhead expense went on whether half the men worked or they all worked, and that the production was materially lowered by the loss of that half hour or more, they began to discourage this practice.

The men had been in the habit of coming to a window in the office for their wages on pay-day and by this method they were sometimes forced to wait over a half-hour before the last man had received his money. Needless to say, this method did not tend to create any very pleasant feeling on the part of the men.

Cages were erected, one on each floor, which



FORMS 29 and 30: These forms are of the greatest value in maintaining a force of good workers by weeding out the tardy ones, thus holding up production figures

would fold against the wall when not in use, from which the men were paid off. This method required less than ten minutes instead of thirty.

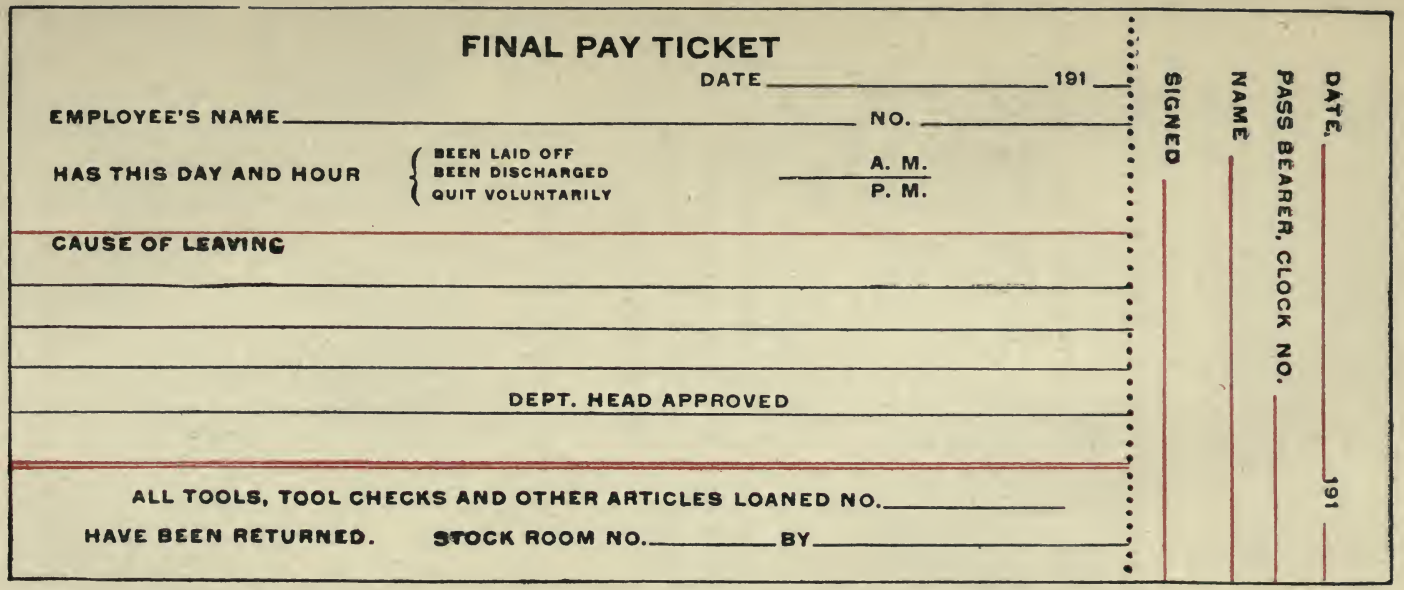
Occasionally a workman would report the loss of his pay-check and would desire his money without it. It was found that in some instances an employee was unable to call for his money and a fellow employee would obtain it on this plea and later the absent employee would call for it. There was no means of identifying the party who had obtained the pay, so we decided to issue a "duplicate pay-check" (Form 26).

The employee who required one of these was obliged to wait until the day following pay-day and then present himself at the time-office with his foreman to identify him. The latter was obliged to endorse this pay-check.

Like all firms, it was often found necessary to advance the wages of some of the employees. For this purpose the blank shown (Form 27) was filled out by the foreman, O. K.'d by the superintendent and in some instances approved by the manager.

Whenever it was necessary to transfer an employee from one department to another a report (Form 28) was issued, and when it was approved by the proper authority the report was sent to the timekeeper. The changes in the clock-numbers took effect the first day of the pay-period. All of these employees' records were filed in an envelope under his number and it was possible to refer to his whole history at any time.

To reduce the number of docked cards a "tardy list" (Form 29) was prepared at the close of each pay-period and a copy forwarded to each department-head concerned.


FINAL PAY TICKET

DATE _____ 191__

EMPLOYEE'S NAME _____ NO. _____

HAS THIS DAY AND HOUR { BEEN LAID OFF / BEEN DISCHARGED / QUIT VOLUNTARILY } _____ A. M. / P. M.

CAUSE OF LEAVING

DEPT. HEAD APPROVED

ALL TOOLS, TOOL CHECKS AND OTHER ARTICLES LOANED NO. _____

HAVE BEEN RETURNED. STOCK ROOM NO. _____ BY _____

DATE 191

PASS BEARER, CLOCK NO.

NAME

SIGNED

FORM 31: When a man leaves the company his pay ticket is made out in this way and all losses of tools are prevented because the ticket is not ready for payment till all tools are returned and receipted for

A summary of these was also furnished the superintendents. Its effect was in every way very beneficial.

In the time department was also kept a "lost-time report" (Form 30) for each employee. This sheet was good for a year's report and reference might be had to it when decreasing the working force or weeding out the irregular ones.

When an employee left the company's service the department head issued a "final pay-ticket" giving the cause and other information. This is shown in Form 31. The tool and supply stockkeeper would then receipt on this card for all tools loaned and returned. Such articles as belonged to employees were passed out by the watchman upon presentation of the stub. The paymaster was notified immediately by telephone so that he could make up the employee's time.

IMPREST CASH VOUCHER NO._____

DATE_____ 191__

RECEIVED FROM THE AUTO MFG. CO. $_____

_____ DOLLARS

FOR_____

SIGNED

CHARGE ACCOUNT	ENTERED ON SUMMARY NO.	CERTIFIED CORRECT
	DATE ENTERED ON SUMMARY	APPROVED BY

FORM 32: When the pay-master's petty cash runs low he uses this voucher for reimbursement

His wages were taken from the imprest cash kept in the time-office for this purpose.

When his cash became low a cash voucher (Form 32) was issued to reimburse his petty cash. This latter must be accounted for at all times. A "denomination sheet" (Form 33) was used in making up the pay-roll for the bank.

RULES FOR SYSTEM

SEE that a broad view of the subject is taken, and provision made for properly dovetailing the various departmental systems.

Make the connection clear to all employees by the use of a chart. Such a table is self-interpreting and saves much explanation.

Do not treat the system as a fetich. It is a good servant, but a bad master. So much of it as is justifiable is merely organized common sense. Prune and pare your system without stint, until it gives the utmost economy and dispatch. There are many daily items of shop practice being perpetuated in expensive card systems today, of which no use whatever is being made, or is ever likely to be made.

—JOHN CALDER

IV

MORE WORK IN THE SAME SPACE

WHAT has been told in the preceding chapters has referred more particularly to the accounting end of the business. After the routine of handling materials and pay-roll had been straightened out, production methods were considered.

Our production was thought to be very good, for the size of the plant, when compared with plants of similar proportions. However, the demand for greater production became so urgent that something had to be done and that quickly. To make a small addition would be false economy as the property was situated so that it was possible to build in only one direction. Plans had been drawn in which it was proposed to tear down the major portion of the present plant and build a much larger factory on a piece of property in the immediate neighborhood.

In view of this, it was advisable to see if production could not be boosted up without increasing the floor space. This meant to get definite data on the production of each department and the space assigned to each. In the past the factory manager had been content to

take the daily shipments for his production data. Of course, with these only, he had no means of checking up the various departments as they might all be held up because of the delay of one department in getting out the work.

Specification sheets were prepared. Every item that entered into the makeup of a body or top was entered upon a sheet. As far as possible each of these items was assigned a serial number by which it was known. Of course, such items as glue, thread, and so on, were not given numbers. After these sheets were completed it was possible to work intelligently. Inventory had been taken so we knew what was in stock and through our newly installed stock record systems we could tell the quantity on hand above orders.

When a new lot of bodies or tops were to be made (which was about once each week, each lot being two hundred and fifty) the production order was issued by the factory manager. The original (Form 34) was retained by the factory manager, duplicate (Form 35) sent to the cost department. On the reverse side of this was space ruled for the cost records which will be taken up in detail further on. Each department was furnished with a copy of Form 35.

All operations were listed and numbered and copies supplied to the various departments interested. A "finished stock schedule" (Form 36) was issued for each part required and the necessary daily production noted on same. As the parts were sent from one department to the next it was accompanied by an "interdepartmental receipt" (Form 37). The foreman receiving goods checked the quantity received with the receipt and re-

ceipted for same. The duplicate was returned to the department issuing same while the original was collected by the office boy at short intervals and turned over to the factory manager. It was then a small matter to enter these upon the finished stock schedules. If production was behind schedule set, or increasing to the detriment of other parts, steps to remedy the conditions could be taken immediately.

By means of this the cause of the delay in shipments was soon ascertained, something which was obviously entirely out of the question before. Of course reasons would be advanced by all questioned, but as these varied with the parties they did not count for very much. If a foreman found that his supply of stock was running low he immediately sent a copy of the "daily shortage report" to the superintendent. He followed up the reason.

Each day's production was shipped the following day with but very few exceptions and the "shipping memorandum" (Form 38) was used. The original went with the goods or the Bill of Lading when shipped by rail, duplicate retained by shipping clerk, triplicate sent to the accounting department from which the invoices were made, while the last copy was sent to the superintendent.

The factory manager was supplied with a "memorandum of daily shipments" (Form 39) by the shipping clerk. From these it was possible to tell at a glance the totals for the day, for each model, and also the total to date. In the top plant shipments were made mostly by rail and were usually made but two or three times per week instead of daily. Memoranda of shipments as made were supplied to the manager the same as that for the bodies.

What fits in one business very well may not

PRODUCTION ORDER

ORIGINAL

NAME | S. O. NO. | L. O. NO.

PRODUCTION	STORES	COST	MACHINE	BENDING	UNDERBODY	SEAT	ASSEMBLY		

DATE CLOSED: | DATE REQUIRED: | DATE ISSUED.

PRODUCTION ORDER

DUPLICATE

NAME | S. O. NO. | L. O. NO.

PRODUCTION	STORES	COST	MACHINE	BENDING	UNDERBODY	SEAT	ASSEMBLY		

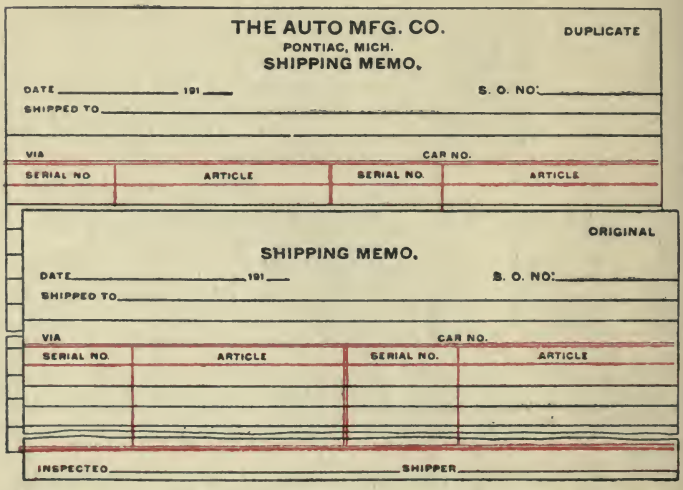
DATE CLOSED: | DATE REQUIRED: | DATE ISSUED:

APPROVED: | ISSUED BY

MATERIAL	QUANTITY	VALUE	MATERIAL	QUANTITY	VALUE	COST SUMMARY
						LABOR
						MATERIAL
						HOURLY BURDEN
						TOTAL COST
						COST EACH
TOTAL			TOTAL			

FORMS 34 and 35: The production order and duplicate, issued by the factory manager when each new job is started, are helpful in controlling production

do at all in another, and it therefore behooves each manager to investigate the merits of any system and endeavor to determine for himself as to the adaptness of it for his own use.



THE AUTO MFG. CO.
PONTIAC, MICH.
SHIPPING MEMO.
DUPLICATE

DATE _____ 191__ S. O. NO: _____
SHIPPED TO _____

VIA _____ CAR NO. _____

SERIAL NO.	ARTICLE	SERIAL NO.	ARTICLE

ORIGINAL

SHIPPING MEMO.

DATE _____ 191__ S. O. NO: _____
SHIPPED TO _____

VIA _____ CAR NO. _____

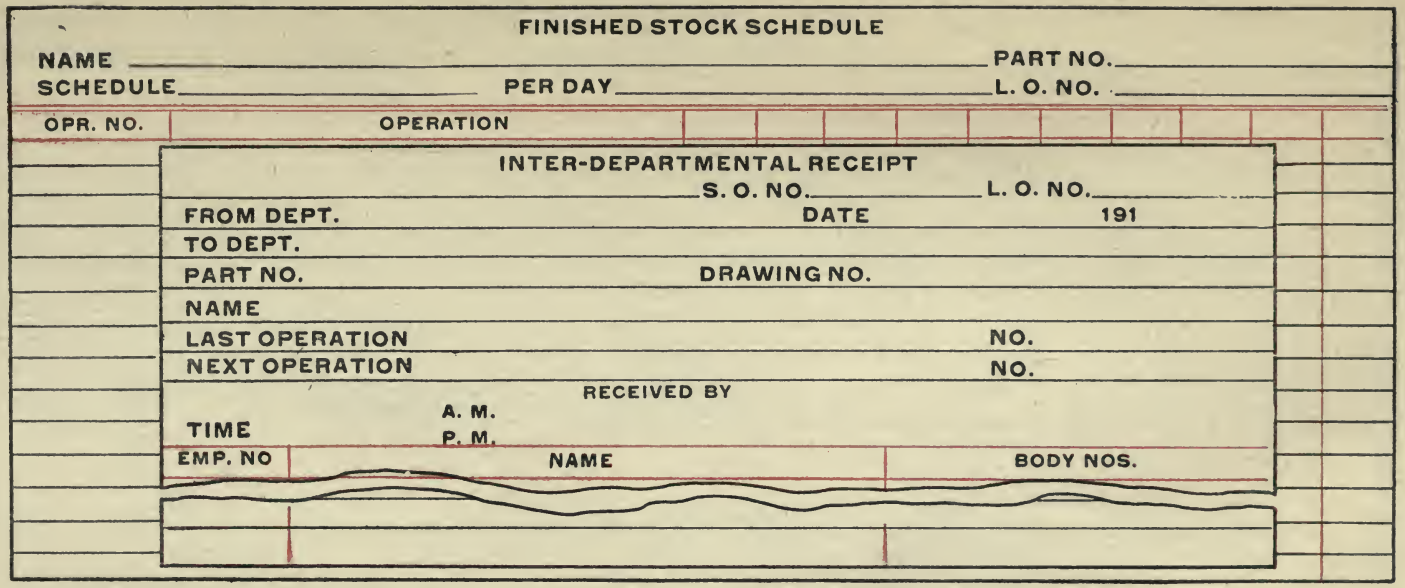
SERIAL NO.	ARTICLE	SERIAL NO.	ARTICLE

INSPECTED _____ SHIPPER _____

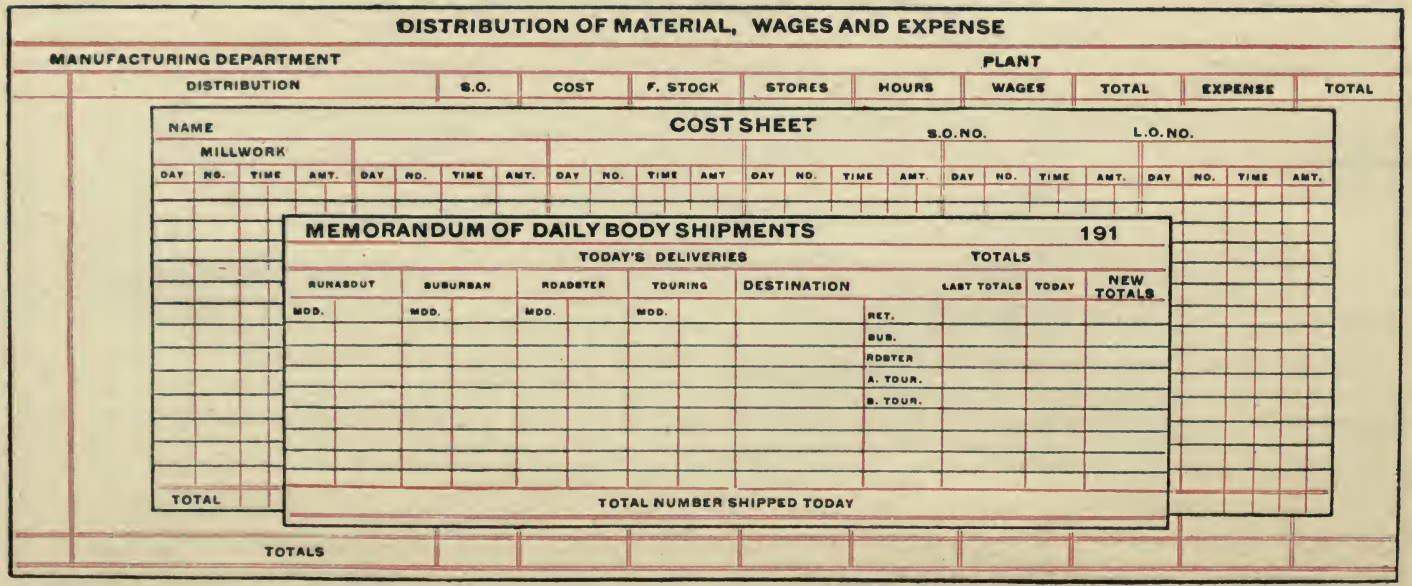
FORM 38: Is made out in triplicate. From the third copy, invoices are made out

In the cost system outlined below it was not desired to ascertain the individual cost of the various parts used, though to do this would have meant merely the extension of their detail. The first step was to set up the "manufacturing accounts" separate from the "general accounts." These are shown below and included everything pertaining to the cost of manufacturing.

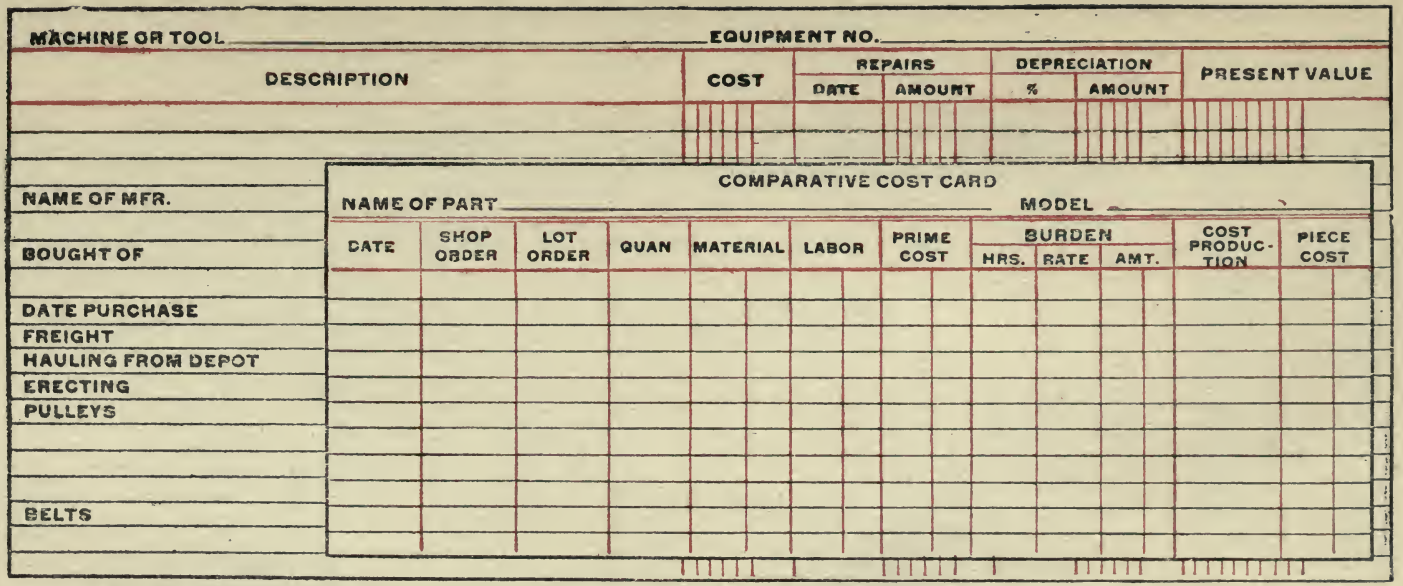
After this had been accomplished each department was assigned standing shop orders to cover all supplies of various natures. Whenever any such supplies were required they were requisitioned out from stores on these numbers. It was then possible to fix the overhead expense for supplies on each department and these costs could be used to check the following month's report.



FORMS 36 and 37: These two forms help the routing and marshalling of parts. By getting finished parts into the assembling room at the right time it is possible to make more prompt shipments



FORMS 39, 40 and 41: A memorandum of daily shipments showing the total for each day. The monthly manufacturing report at the back shows the cost of jobs in progress and an analysis of expenditure. The cost sheet gives detail daily labor cost figures



FORMS 42 and 43: At the back is an inventory card for listing machinery on hand and all newly purchased equipment. In front is a cost summary record

At the end of each month a manufacturing report was made out showing the cost of jobs in progress, jobs completed and an analysis of the departmental expense. For this purpose Form 40 was used. As each shop order was issued the duplicate copy came to the cost department and was placed on file. Each morning the timekeeper sorted out the time-cards and piece-workers' slips turned in according to the order numbers. They were then posted on the back of this order copy. If this copy became filled an additional sheet (Form 41) was used. Upon completion of the order the various requisitions were sorted and extended and then totaled according to the material after which they were posted on the order sheet. The labor could then be totaled and the overhead expense ascertained from the monthly report. The total of these three would be the cost of manufacture.

We could then post these costs on the "comparative cost record" (Form 42) from which it is possible to watch the costs. In case any increase over a previous order was found the manager could quickly locate the reason as the shop orders were issued for amounts covering as a rule but one week's production and anything unusual would be fresh in the minds of all department heads.

An inventory of all machinery and other equipment was made and each piece assigned an equipment number. Equipment sheets (Form 43) were made out for these and all charges for repairs, replacements, and so on, were noted on same. From these sheets we could tell the valuation of the plant equipment.

EACH UNIT A MACHINE

EACH unit in a factory, whether it is a department or a building, may be considered a machine with certain functions. To keep that machine operating at its highest speed and with the greatest efficiency means that the "use-factor" of that section or of that building approaches the hundred per cent mark.

It may take only a general study of a department to show where time is wasted, where output might be doubled if little changes in equipment for handling material, better light, different arrangement or methods of handling machines were made. Or it may take a stop-watch study of detail operations to point to the weak spots and losses.

—P. L. BATTEY

V

SMOOTHING OUT KINKS IN ROUTINE

ONE large motor car company kept quite a considerable force in their engineering department employed continuously. Efforts had been made at different times to cut down the size of the force, but eventually it became necessary to increase it to its former size and occasionally to exceed that. The majority of the engineering force was engaged upon routine work. The size of the experimental engineering department was kept within close bounds. To add to the difficulties the personnel of the force was changing unexpectedly at all times. The employees seemed to feel that their positions were somewhat insecure and at the first opportunity would leave.

How the Engineering Department Was Reduced and Its Efficiency Increased

Under the old regime it had been customary to keep several high grade men on who were supposed to be capable of handling any kind of engineering work which might come up. One man would be working upon motor designs and later be switched off on to chassis or

running gear designing. As a result no one man was thoroughly conversant with any one group. As regards the detailers, they were grouped into those capable of handling intricate details and those whose ability was limited to the minor details. Then came a large number of tracers whose sole duty it was to trace on cloth the details made by the detailers. In all, about forty-five men were required to handle the work.

The salaries paid were as follows: designers, $115 per month; A1 detailers, $95 per month; second class detailers, $80 per month; tracers, $40 to $65 per month. The new system was arranged on the following plan: designers instead of being assigned to all classes of work were grouped into squads. One man was placed in charge of all motor and transmission work. Everything pertaining to power plant came under his jurisdiction. For this he was paid $150 per month. This salary was greatly in excess of the former salary, but the object in paying it was to insure a really good man on the job (which was quite impossible before) and keeping him there.

To another was assigned everything pertaining to bodies, tops, fenders, and so on. One had everything connected with steering gear, axles, springs, and so on, a fourth had the chassis and all control mechanism, and the fifth had experimental work. These men constituted the engineering department and were held responsible for everything under their direction. The drafting room now consists of tracers and the second grade of detailers only. The best among the detailers have been distributed as assistants in the engineering department. All designs are worked up by the engineers in charge and the princi-

pal details made by their assistants. As each engineer has but one assistant it will be seen that the force is not exceptionally large. After the designs and major details progress sufficiently far, a part list giving the name of each and every part is made up by the engineer for reference. Then a requisition is made by him upon the chief draftsman for additional assistance. The chief draftsman assigns other men to assist the engineer in getting out the details. Usually not more than one man is required, at the most, two. The details are made upon a tracing paper and after receiving a general check from the engineer they are turned over to the checker in the drafting room.

How Blueprints Are Made and Issued to the Experimental Department

After the experimental work has been completed and the necessary minor changes incorporated on the drawings these same drawings are traced upon cloth. Inasmuch as the detail drawings have been checked, it is possible for a tracer to perform twice as much work as formerly because he is not obliged to confer with the detailers in regard to the drawings.

If the experimental department finds that certain details in design require changing they report to the engineer in charge of that work and not to the chief engineer. After the work has reached the manufacturing department, it sometimes becomes necessary to make minor changes. These are always referred to the engineer in charge. In this way a vast amount of purely routine labor has been removed from the chief engineer and assigned to men who are more conversant with the small details.

The chief draftsman was not obliged to keep

a large force of designers on hand, each familiar in a general way with motor car design and apt to leave at any time. The size of the entire force was reduced from forty-five men to twenty men made up as follows: five engineers, five assistant engineers, five detailers and tracers and five tracers.

Every week the engineers were called into conference with the chief engineer, general manager and the factory superintendent. These conferences would usually take up about two hours and all questions pertaining to design and manufacture were thoroughly discussed. The former chief engineer was made the consulting engineer and was consulted by the general manager in regard to all engineering problems. The former assistant engineer was made chief engineer in charge of the engineering department, the experimental department, laboratory and drafting department. It was found that by the adoption of this plan the expense of operating the engineering department was decreased, new work was greatly expedited, because the engineer in charge knew that he must report progress to the general manager. However, no difficulty was experienced as numerous applications were received from first class men who had reached the limit (about $125) paid in drafting rooms, and from these the new engineering department was recruited.

How a New Scheme for Specifying Tools to Use Was Inaugurated

All special taps and dies, reamers and other small tools were listed upon data sheets in the drafting department. All sheet metal parts, those requiring steel tubing, and so on, were compiled. It was found that in several cases

parts were made from different gauges which could have been made from the same gauge as well as not. The material specifications were changed so as to call for the same gauge where possible. Certain gauges were then compiled on a data sheet and future drawings called for gauges contained thereon instead of leaving this question to the draftsman. All broaches were listed and when new details were drawn up the detailers and checker were instructed to use standard tools where possible. In this way many small tools were saved as previously the drafting room was not informed on this subject. The many variegated stocks of material were decreased and it became possible for the purchasing department to order a larger supply which, of course, enabled it to get better prices.

One man in the laboratory was placed in charge of all material specifications. It was his duty to specify the analysis and treatment of the different metals used. In the laboratory was a complete chemical and physical equipment which was used far more than under the old plan. In several instances it was possible to reduce the size of certain screws and studs by substituting a little better grade of steel at practically no extra cost. Repairs due to defective material or poor design were gradually eliminated because certain men were held responsible for these items.

A small library was also started by the engineering department in which were filed all technical papers, catalogs, and so on, of interest to that department. This was placed in charge of a clerk and copies were furnished upon requisition. This eliminated no small amount of delay due to the inability to obtain certain information contained in catalogs or

trade papers. It was the duty of the clerk to keep on file everything obtainable regarding automobiles and tools.

In the factory several accidents resulted to employees due to finger rings catching in moving machines or tools. While the company was not legally responsible for these accidents, still the fact that an employee's finger was injured decreased his working efficiency. A notice was then posted to the effect that all employees must remove finger rings during working hours or else wear working gloves, the reasons for this order being given. As a result the number of minor accidents was greatly decreased.

The factory engineer was requested to furnish figures showing the safe loads which could be carried upon the different floors. Signs were then posted in each department giving this information. Foremen were instructed to see that these figures were not exceeded. In several instances it was found that heavy castings, and so on, were stored in such small quarters that the safe load was greatly exceeded. Steps were immediately taken to correct this.

Each building is separated from the adjoining one by a brick wall, and brick fire partitions separate most of the departments. Fire doors are provided and an elaborate sprinkler system. However, a fire broke out one night and the firemen lost considerable time in locating the source of fire. The fire was confined to one department, but the firemen entered a window on the wrong side of the brick wall. The next day a large white strip was painted on the outside walls showing the fire walls. In addition to this a bulletin was posted up at the main entrance giving the location and sizes

of the various hydrants distributed throughout the plant.

Considerable trouble had been experienced in one plant due to the wrong material being dispensed by the stockroom. This applied to the analysis of different steels. For some reason steel of one analysis was placed with that of another. Inasmuch as it was impossible to discern one from the other by appearance, recourse was had to assigning a number to each analysis, and each bar was painted on the end with this number as soon as received. It is now an easy matter to keep the stock straight.